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ANNUAL REPORT (8TH) OF THE MACHINABILITY DATA CENTER

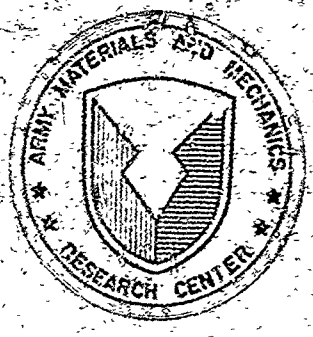
Robert E. Snider

Machinability Data Center

Prepared for:

Army Materials and Mechanics Research Center

September 1972



AMMRC CTR 72-18

EIGHTH ANNUAL REPORT OF THE MACHINABILITY DATA CENTER

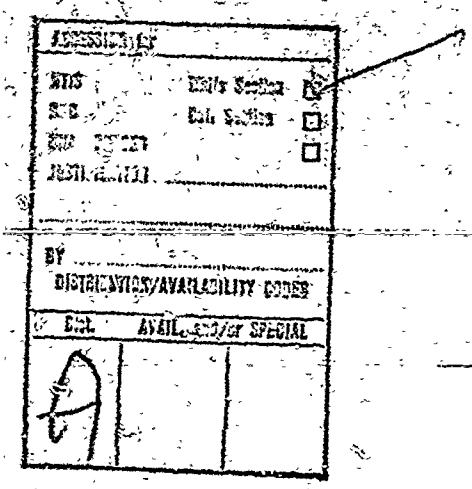
SEPTEMBER 1972

ROBERT E. SNIDER
Metcut Research Associates Inc.
Cincinnati, Ohio

EIGHTH ANNUAL - CONTRACT F33615-71-C-1112

Prepared for

ARMY MATERIALS AND MECHANICS RESEARCH CENTER
Watertown, Massachusetts 02172



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Metcut Research Associates Inc.
Cincinnati, Ohio 45209

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13. ABSTRACT

During it's eighth year of operation MDC has evaluated and processed an additional 2,148 technical documents on machining data and related topics. From these documents coded evaluations have resulted in keypunching of an additional 9,491 punched cards, which are in turn recorded on organized computer files. These computer files represent an automated index to a physical file of more than 30,000 individually coded documents. These documents represent 79,268 individual records such as the type of operation, speed, feed, condition, hardness, material group, etc. The results of a computer search on any given set of input parameters of these documents would result in an output listing of document file numbers which would facilitate manual retrieval of the specific hard copy documents from the physical file previously mentioned.

Approximately 247 specific inquiries of this nature were answered for 156 different organizations representing 186 individuals, during this reporting period. Since the Center's inception in October 1964, a total of 6,793 inquiries have been processed.

Statistics are presented for estimated cost savings from MDC's services to it's users. Through July 31, 1972, it has been conservatively estimated that these savings amounted to more than $59,500,000.

Also in this report are tables and information reflecting MDC activity in other areas related to data publications, government activity, types of inquiries, etc.

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Reviews						
Data Processing Systems						

AMMRC CTR 72-18

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PROJECT 9M810 – 8975
TASK NO. 897506

Prepared for

ARMY MATERIALS AND MECHANICS RESEARCH CENTER
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FORWARD

The Eighth Annual Report of the Machinability Data Center (MDC) covers work performed under Contract F33615-71-C-1112 from October 1, 1971, through July 31, 1972. The work described in this report covers that accomplished under project No. 8975, Materials Information Analysis Centers, Task No. 897506, Machinability Data Center. It also cites some statistics covering the 7¾ years that MDC has been in operation. This Center is operated for the Department of Defense under the supervision of the Army Materials & Mechanics Research Center, by Metcut Research Associates Inc., 3980 Rosslyn Drive, Cincinnati, Ohio 45209. The manuscript was released by the author, Robert E. Snider, Manager of MDC, in August 1972 for publication as an MDC report.

During the contract period covered by this report work was administered by the Air Force Materials Laboratory with Mr. E. L. Horne (LAM) as program monitor from October 1, 1971 to May 31, 1972. From June 1, 1972, to July 31, 1972, work was administered by the Army Materials & Mechanics Research Center (AMXMR-XP) with Dr. John J. Burke as program monitor.

For a complete analysis of the progress made by the Center from its early inception to the present. the following eight references should be reviewed:

"Final Report on the Design of a System for Collecting, Evaluating and Disseminating Machinability Data for Aerospace Materials," Technical Documentary Report Nr. ASD-TDR-63-572, July 1963, AD-416743.

"First Annual Report of the Air Force Machinability Data Center," AFMDC 65-2, February 1966, AD-482278

"Second Annual Report of the Air Force Machinability Data Center," AFMDC 66-4, February 1967, AD-813037.

"Third Annual Report of the Air Force Machinability Data Center," AFMDC 67-8, February 1968, AD-829879.

"Fourth Annual Report of the Air Force Machinability Data Center," AFMDC 68-6, October 1968, AD-844920.

"Fifth Annual Report of the Air Force Machinability Data Center," AFMDC 69-6, October 1969, AD-697794.

"Sixth Annual Report of the Air Force Machinability Data Center," AFMDC 70-5, October 1970, AD-722478.

"Seventh Annual Report of the Machinability Data Center," MDC 71-1, April 1972, AD-740916.

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Also in this report are tables and information reflecting MDC activity in other areas related to data publications, government activity, types of inquiries, etc.

TABLE OF CONTENTS

INTRODUCTION

The Machinability Data Center has been operated continuously since October 1, 1964, by Metcut Research Associates Inc. From October 1, 1964 through October 1, 1968, the Center operated under contracts from the Manufacturing Technology Division of the Air Force Materials Laboratory. On October 1, 1968, government administration of the Center was changed to the Materials Information Branch of the Air Force Materials Laboratory. Another change of administration took place during this contract period on August 1, 1971. The Defense Supply Agency assumed contract responsibility with the Materials Information Branch of the Air Force Materials Laboratory at Wright-Patterson Air Force Base continuing technical monitoring of the Center's activity. On May 31, 1972, technical monitor responsibilities were assigned to the Army Materials & Mechanics Research Center, Arsenal Street, Watertown, Massachusetts.

This Eighth Annual Report of the Machinability Data Center presents accomplishments and progress during the period from October 1, 1971 through July 31, 1972.

This report contains charts reflecting data input activities and the scope of services provided industry and government in answering technical inquiries and the dissemination of data through the sale of data publications.

DESCRIPTION OF MDC

MACHINABILITY DATA CENTER, 3980 ROSSLYN DRIVE, CINCINNATI, OHIO 45209. Operated for the Department of Defense, Defense Supply Agency, with technical aspects being monitored by the Army Materials & Mechanics Research Center, Arsenal Street, Watertown, Massachusetts, under Contract F33615-71-C-1112, by Metcut Research Associates Inc.

SCOPE

The Machinability Data Center (MDC) collects, evaluates, stores, and disseminates material removal information including specific and detailed machining data for the benefit of industry and government. Strong emphasis is given to engineering evaluation for the purpose of developing material removal parameters, such as speeds, feeds, depths of cut, tool material and geometry, cutting fluids and other significant variables. Data are being processed for all types of materials and for all kinds of material removal operations such as turning, milling, drilling, tapping, grinding, electrical discharge machining, electrochemical machining, etc.

COLLECTION

MDC has a data file of over thirty thousand selected documents pertaining to material removal technology. This data file is supported by a retrieval system which is controlled by an IBM 1130 computer installation. Information retrieval is based upon the specific material (with definite chemical, physical, and mechanical properties) and the specific material removal operation being used. Computerized search techniques are employed utilizing a combination of search parameters to produce source data. Information retrieval can be refined to the extent necessary to satisfy the requirements of a specific inquiry by controlling the input search parameters.

INFORMATION SERVICES PROVIDED BY MDC

MDC maintains an intensive effort to serve as a communication link for both government and industry by providing services related to the field of material removal. MDC's output consists of providing analyzed data in response to technical inquiries, compilation and marketing of data publications on subjects of current interest to the manufacturing industry. MDC also maintains a selected mailing list for providing notification of the availability of new information and services from the Center.

TO REQUEST MACHINING INFORMATION.....

Telephone: 513-271-9510
TWX: 810-461-2840 or
Write: Machinability Data Center
3980 Rosslyn Drive
Cincinnati, Ohio 45209

****

NOTE: *Association of the names of companies and individuals with specific requests is kept confidential. However, data developed remain the property of MDC for dissemination as required for answering similar inquiries and for developing data publications*

SUMMARY OF MAJOR ACTIVITY

Contract Changes

Technical monitoring of the Center's contract (F33615-71-C-1112) was changed effective May 31, 1972, from the Air Force Materials Laboratory to the Army Materials & Mechanics Research Center, Arsenal Street, Watertown, Massachusetts.

Inquiry Service Charges

The terms of the new contract, covering the period of this report, stipulated that a service charge system would be initiated for MDC products and services. The objectives of this service charge system would be aimed at achieving a rate of gross income equal to at least 50% of the contract funding by December 31, 1972.

A service charge policy was implemented by MDC effective January 1, 1972. This policy fixed a charge for inquiry services based upon the complexity of the inquiry and the total effort required by the Data Center. Charges for data publications were also adjusted to meet the stated objectives.

The following table shows a breakdown of inquiries received during each month of this reporting period:

		Total Inquiries	Total Paid
1971	October	60	
	November	62	
	December	60	
1972	January	18	8
	February	12	7
	March	11	8
	April	3	3
	May	4	1
	June	12	9
	July	5	4
		247	40

By referring to the above table it can be seen that the announcement of the service charge policy in January 1972 brought about a sharp decrease in the number of specific inquiries each month thereafter. Only 65 inquiries were received between January 1, 1972 and July 31, 1972. Of this total, only 40 were in sufficient detail to require a service charge. The others were answered by

Inquiry Service Charges (cont.)

telephone. Many requests for information were received, but when the service charge policy was explained, the User generally rejected the services of MDC because of a lack of administrative procedures within the User company to handle even nominal charges for inquiries.

An extensive effort was made by MDC during the contract period to reach an accommodation with the large prime contractors of the aerospace industry and other large company Users of MDC's services regarding a blanket order or minimum annual fee for inquiry services. Charges for individual inquiries would be credited against this annual fee according to the complexity of the individual inquiry. This method of charging for inquiry services has found a very limited degree of acceptance by those companies contacted. Negotiations in this area are continuing at the time of this report. To date two different User organizations have agreed to budget a specified dollar amount for annual inquiry services. Neither of these constitute a blanket order to MDC since inquiries are paid for on an individual basis. The total amount of these budgeted agreements is $2,800.

Data Publications

While specific inquiry services decreased sharply, MDC publication sales were encouraging. The Second Edition of the Machining Data Handbook was printed and placed in distribution in April 1972. Through July 31, 1972, orders for 1,877 copies of the revised Handbook have been received. Sales of MDC data publications, particularly the Machining Data Handbook, have made it possible for MDC to achieve a cost recovery rate consistent with contractual requirements.

MDC Newsletter

A bimonthly newsletter service was initiated in January 1972 with distribution to the individuals who are maintained on MDC's selected User File. The newsletter is intended to keep MDC's Users informed concerning new ideas and developments in the metal removal industry, with particular reference to machinability data. Information is also provided to industry and government regarding new MDC data publications. This newsletter has stimulated increased activity in the sale of MDC data publications

DISTRIBUTION OF MDC USER FILE

Names are added to the User File as a result of: 1) inquirers, 2) visitors, 3) additional names submitted by current Users, 4) requests resulting from dissemination of data publications, and 5) technical articles published in periodicals and announcements pertaining to the Center.

GENERAL CONCENTRATION OF USERS BY NUMBERS

STATES	ORGANIZATIONS	TOTAL NO. ORGANIZATIONS	STATES*	INDIVIDUAL	TOTAL INDIVIDUAL USERS
7	0	0	7	0	0
14	1-10	72	13	1-25	171
17	11-25	312	13	26-50	468
5	26-50	178	10	51-125	694
3	51-100	195	7	126-300	1,510
9	OVER-100	1,831	5	OVER-300	3,117
	TOTAL	2,588		TOTAL	5,960

AREA CONCENTRATION OF ORGANIZATIONS

West Coast (3 states)-	310 companies
Midwest (5 states) -	931 companies
North Central (3 states) -	538 companies
New England (6 states)-	283 companies

The total User File (5,960 individuals and 2,588 plants), can be broken down as follows:

Company Users	(Individuals)	5,161
	Companies	2,350
Educational Institutions	(Individuals)	692
	Colleges	204
Societies, Centers, etc.	(Individuals)	107
	Societies, Centers, etc.	34

* *Includes Washington, D.C.*

SUMMARY OF SPECIFIC INQUIRIES BY TYPE OF INQUIRY

October 1, 1971 – July 31, 1972

	NO. OF INQUIRIES 10/1/71–7/31/72
1. RECOMMENDATIONS FOR A SPECIFIC MACHINING SITUATION. *Typical Example:* Requested recommendations for turning Waspaloy in the solution treated and aged condition.	47
2. STARTING RECOMMENDATIONS FOR AN EXTENSIVE GROUP OF MACHINING SITUATIONS. *Typical Example:* Requested machinability data on AM-350, S-816, HS-25, HS-31, Inconel X-750, Unitemp M-252 and Kastelloy R-235.	73
3. INFORMATION PERTAINING TO NEW MACHINING PROCESSES, EQUIPMENT AND TOOLS. *Typical Example:* Requested information on the manufacturer of equipment called "Liquid Lathe".	15
4. COORDINATION AND POTENTIAL USE OF AFMDC. *Typical Example:* Requested detailed information on services available from AFMDC.	7
5. *REQUESTS FOR SPECIFIC DOCUMENTS, REPORTS, BOOKS, PAPERS, ETC. *Typical Example:* Requested a list of reports available for machining of titanium. Also wanted cost of each report.	3
6. GENERAL INFORMATION SUCH AS SAFETY PRACTICES, NAMES OF FIRMS HAVING CERTAIN MACHINING CAPABILITIES, TOOL MATERIAL PROPERTIES, ETC. *Typical Example:* Requested the names of people to contact in the fields of metal removal such as EDM, ECM, ECG, EDG, USM, CHM, LBM, Abrasive Machining and Hot Machining.	18
7. REQUESTS FOR BIBLIOGRAPHIES AND ABSTRACTS. *Typical Example:* Request for bibliographies with abstracts covering use of ceramic tools and abrasives in machining various materials.	8
8. STATE-OF-THE-ART INFORMATION AND REPORTS *Typical Example:* Suggestions for important manufacturing programs for the next five years in the field of material removal. Supply problem, approach and approximate funds.	2

SUMMARY OF SPECIFIC INQUIRIES BY TYPE OF INQUIRY (cont.)

October 1, 1971 – July 31, 1972

		NO. OF INQUIRIES 10/1/71-7/31/72
9.	SPECIAL INQUIRIES AND REPORTS FOR U.S. AIR FORCE, MANUFACTURING TECHNOLOGY DIVISION. *Typical Example* Requested a report on the progress during the last five years in machining of titanium and hard to machine materials - state-of-the-art.	7
10.	EVALUATION, TRANSLATION AND REVIEW OF REPORTS, BOOKS, PAPERS. *Typical Example* Requested an evaluation of a report published in Electro-Technology, October 1964, concerning adaptive control possibilities.	2
11.	REQUESTS FOR INFORMATION ON METAL REMOVAL RATES. *Typical Example* Requested information on maximum metal removal rates in turning and drilling of leaded steels.	1
12.	COMPARISON OF ONE PROCESS OR MATERIAL WITH ANOTHER. *Typical Example* Requested a comparison of the machining of Inconel W with Inconel X in both solution treated and solution treated and aged conditions, primarily in turning but also drilling and milling if possible.	7
13.	INFORMATION PERTAINING TO CUTTING FLUIDS. *Typical Example* Requested cutting fluid recommendations for titanium and a wide variety of high temperature alloys and stainless steels.	6
14.	INFORMATION ON MACHINABILITY RESEARCH. *Typical Example* Requested machining information on the effect of work diameter on tool life, mathematical correlations of the various machining processes and the means of predicting the surface quality in milling.	15
15.	INFORMATION PERTAINING TO ESTIMATING COST, SETTING TIME STANDARDS, AND PRODUCTION RATES IN MACHINING. *Typical Example* Requested information including formulas that could be used to predict production rates and costs.	36
	TOTAL	247

This total does not include requests for published data publications such as AFML reports.

ANALYSIS OF INQUIRIES BY STATE

October 1, 1971 – July 31, 1972

10 STATES LEADING INQUIRIES			
STATES	COMPANIES	INDIVIDUALS	NO. OF INQUIRIES
California	10	12	12
Illinois	7	7	7
Indiana	9	10	11
Massachusetts	4	4	8
Minnesota	4	4	7
New Jersey	4	4	7
New York	8	11	12
Ohio	46	63	98
Pennsylvania	18	19	24
Texas	3	4	6
Wisconsin	6	6	6
TOTAL	119	144	198
OTHER STATES SUBMITTING INQUIRIES			
Arkansas	1	1	1
Colorado	2	2	2
Connecticut	4	5	5
Delaware	1	1	1
District of Columbia	1	1	1
Georgia	1	1	1
Idaho	1	1	1
Iowa	1	1	1
Kansas	1	1	2
Kentucky	2	3	5
Louisiana	2	3	5
Michigan	5	5	5
Mississippi	1	1	2
Missouri	4	4	4
New Hampshire	2	2	2
Oklahoma	1	1	1
Rhode Island	2	2	2
Tennessee	2	3	3
Vermont	2	2	4
Washington	1	1	1
TOTAL	37	42	49
TOTAL FOR ALL STATES	156	186	247

ANALYSIS OF INQUIRIES BY MATERIAL GROUP

October 1, 1971 – July 31, 1972

MATERIAL GROUP	INQUIRIES
PLAIN CARBON & LOW ALLOY STEELS	28
ULTRA HIGH STRENGTH & TOOL STEELS	11
CARBIDES	6
CAST IRON	10
CAST STEELS	3
STAINLESS STEELS	12
NICKEL ALLOYS	1
MARAGING STEELS	1
HIGH TEMPERATURE ALLOYS	48
TITANIUM ALLOYS	12
REFRACTORY ALLOYS	5
BERYLLIUM ALLOYS	1
ZIRCONIUM ALLOYS	1
ALUMINIUM, MAGNESIUM, ZINC, LEAD, COPPER & TIN ALLOYS	18
PRECIOUS & RARE METALS	1
POWDER METALS	3
FOUNDRY METALS	0
NONMETALLICS INCLUDING CERAMICS, PLASTICS, GRAPHITE & COMPOSITES	9
MULTIPLE GROUP	18
OTHER TYPE (NO GROUP)	61

ANALYSIS OF INQUIRIES BY TYPE OF MACHINING OPERATION

October 1, 1971 – July 31, 1972

OPERATION	INQUIRIES
CONVENTIONAL CHIP REMOVAL	
TURNING	29
BORING	5
MILLING (GENERAL)	3
FACE MILLING	5
END MILL SLOTTING	4
PERIPHERAL END MILLING	7
SLAB MILLING	1
ALL OTHER TYPES OF MILLING	3
DRILLING	20
GUN DRILLING	0
REAMING	3
TAPPING	6
GEAR CUTTING	0
BROACHING	7
ROUTING	1
BANDSAWING	2
TOTAL	96
CONVENTIONAL GRINDING	
GENERAL GRINDING	13
SURFACE GRINDING	4
CYLINDRICAL GRINDING	2
INTERNAL GRINDING	0
CENTERLESS GRINDING	1
ABRASIVE MACHINING	1
ABRASIVE BELT GRINDING	0
ABRASIVE CUTOFF	1
HONING	3
TOTAL	25
ALTERNATE MACHINING METHODS	
ELECTRICAL DISCHARGE MACHINING	9
ELECTROCHEMICAL MACHINING	5
ELECTROCHEMICAL GRINDING	0
CHEMICAL MACHINING	7
PHOTOCHEMICAL MACHINING	0
ULTRASONIC MACHINING	0
LASER MACHINING	0
ABRASIVE JET MACHINING	0
SUB-ZERO MACHINING	1
HOT MACHINING	0
THREAD ROLLING	1
TOTAL	23
MISCELLANEOUS	
BURNISHING	1
POLISHING	4
UNITERM DESCRIPTIVE OPERATIONS	58
MULTIPLE OPERATIONS	34
MISCELLANEOUS CONVENTIONAL OPERATIONS	5
TOTAL	102

SUMMARY OF INQUIRIES PROCESSED BY MDC FOR STSP* & SBA**

October 1, 1971 – July 31, 1972

NUMBER OF INQUIRIES FOR STSP*	
STATE	NO. OF INQUIRIES
VERMONT	3

NUMBER OF INQUIRIES FOR SBA**	
STATE	NO. OF INQUIRIES
MASSACHUSETTS	2
MINNESOTA	3
MISSISSIPPI	2
NEW YORK	1
PENNSYLVANIA	1
TEXAS	3
TOTAL	12

STSP* - STATE TECHNICAL SERVICES PROGRAMS

SBA** - SMALL BUSINESS ADMINISTRATION TECHNOLOGY UTILIZATION PROGRAMS

MACHINABILITY DATA CENTER

SUMMARY OF SPECIFIC INQUIRIES BY SIC* NUMBER

October 1, 1971 – July 31, 1972

SIC MAJOR GROUP NO.	SIC INDUSTRY NO.		NUMBER OF INQUIRIES BY SIC INDUSTRY NO.	NUMBER OF INQUIRIES BY SIC MAJOR GROUP NO.	% OF TOTAL
		FEDERAL GOVERNMENT		32	13.0
91	9100	U.S. DEPT. OF THE NAVY	3		
	9100	U.S. DEPT. OF THE AIR FORCE	7		
	9100	U.S. DEPT. OF THE ARMY	1		
	9100	NATIONAL AERONAUTICS & SPACE ADM.	5		
	**9191	STATE TECHNICAL SERVICE PROGRAMS	3		
	9192	SMALL BUSINESS ADMINISTRATION	12		
96	9651	NATIONAL BUREAU OF STANDARDS	1		
19		ORDNANCE AND ACCESSORIES		6	2.4
27		PRINTING, PUBLISHING, AND ALLIED INDUSTRIES		16	6.5
28		CHEMICALS AND ALLIED PRODUCTS		0	0
29		PETROLEUM REFINING AND RELATED INDUSTRIES		5	2.0
32		STONE, CLAY, GLASS, AND CONCRETE PRODUCTS		4	1.6
33		PRIMARY METAL INDUSTRIES		17	6.9
34		FABRICATED METAL PRODUCTS, EXCEPT ORDNANCE, MACHINERY, AND TRANSPORTATION EQUIPMENT		8	3.2
35		MACHINERY, EXCEPT ELECTRICAL		80	32.4
36		ELECTRICAL MACHINERY, EQUIPMENT AND SUPPLIES		19	7.7

* *Standard Industrial Classification Manual (SIC). Executive Office of the President, Bureau of the Budget, 1967*

** *This SIC Number Was Assigned Because of the Special Significance of the State Technical Services Programs*

SUMMARY OF SPECIFIC INQUIRIES BY SIC* NUMBER (cont.)

SIC MAJOR GROUP NO.	SIC INDUSTRY NO.		NUMBER OF INQUIRIES BY SIC INDUSTRY NO.	BY SIC MAJOR GROUP NO.	% OF TOTAL
37		TRANSPORTATION EQUIPMENT		33	13.4
	3721	AIRCRAFT AND MISSILES	7		
	3722	AIRCRAFT ENGINES & ENGINES PARTS - MISSILE ENGINES	14		
	3729	AIRCRAFT PARTS & AUXILIARY EQUIPMENT - MISSILE PARTS	3		
		OTHERS	9		
38		PROFESSIONAL, SCIENTIFIC, AND CONTROLLING INSTRUMENTS; PHOTOGRAPHIC AND OPTICAL GOODS; WATCHES AND CLOCKS		0	0
39		JEWELRY, PRECIOUS METALS		1	0.4
40		RAILROADS, LINE-HAUL OPERATING		0	0
50		WHOLESALE TRADE		6	2.4
73		MISCELLANEOUS BUSINESS SERVICES		7	2.9
82		EDUCATIONAL SERVICES		3	1.2
86		NONPROFIT MEMBERSHIP ORGANIZATIONS		0	0
89		MISCELLANEOUS SERVICES		10	4.0
		TOTALS		247	100.0%

* *Standard Industrial Classification Manual (SIC). Executive Office of the President, Bureau of the Budget, 1967*

COMPANIES AND AGENCIES SUBMITTING INQUIRIES TO MDC

OCTOBER 1, 1971 TO JULY 31, 1972

• INDICATES NEW INQUIRERS

•	AEROJET NUCLEAR CO	IDAHO FALLS, ID
	DEPT OF THE AIR FORCE	ROBINS AFB, GA
	DEPT OF THE AIR FORCE	WRT-PTRSN AFB, OH
•	DEPT OF THE AIR FORCE	WRT-PTRSN AFB, OH
	AIR FORCE MATERIALS LAB	WRT-PTRSN AFB, OH
	AIR FORCE MATERIALS LAB	WRT-PTRSN AFB, OH
	AIR FORCE MATERIALS LAB	WRT-PTRSN AFB, OH
•	ALLIS-CHALMERS MFG CO	HARVEY, IL
•	ALLIS-CHALMERS MFG CO	YORK, PA
	ALUMINUM CO OF AMERICA	CLEVELAND, OH
	AMERICAN MICRO PRODUCTS	CINCINNATI, OH
•	ARMSTRONG CORK COMPANY	LANCASTER, PA
	DEPT OF THE ARMY	ST LOUIS, MO
•	AUTOMATIC MACHS & SYSTS	NEW BERLIN, WI
	AVCO CORPORATION	LOWELL, MA
	AVCO CORPORATION	RICHMOND, IN
	AVCO CORPORATION	STRATFORD, CT
•	ROBERT G AVERILL, MS	RIDGWOOD, NJ
	BABCOCK & WILCOX CO	ALLIANCE, OH
	BABCOCK & WILCOX CO	BEAVER FALLS, PA
	BATTELLE COLUMBUS LABS	COLUMBUS, OH
	BATTELLE-NORTHWEST	RICHLAND, WA
•	BELL TELEPHONE LABS	NORTH ANDOVER, MA
	BELOIT CORP	BELOIT, WI
	THE BENDIX CORP	UTICA, NY
	BLUE ASH TOOL & DIE CO	CINCINNATI, OH
	BRAD FOOTE GEAR WORKS	CICERO, IL
•	BURROUGHS CORP	PAOLI, PA
•	C T R INC	ELK GROVE, IL
	CHRYSLER CORP	DAYTON, OH
	CHRYSLER CORP	NEW ORLEANS, LA
	CINCINNATI MILACRON INC	CINCINNATI, OH
	CINCINNATI MILACRON INC	CINCINNATI, OH
•	CINCINNATI MILACRON INC	CINCINNATI, OH
•	CLIMAX MOLYBDENUM CO	ANN ARBOR, MI
	CONTINENTAL AVIA & ENGRG	TOLEDO, OH
	CONTINENTAL CAN CO	CHICAGO, IL
	COORS PORCELAIN CO	GOLDEN, CO
	CRUCIBLE STEEL CO	PITTSBURGH, PA
	CUMMINS ENGINE CO	COLUMBUS, IN
	CYCLOPS CORP	PITTSBURGH, PA
•	DAS INDUSTRIES INC	BELLEFOUNTAIN, OH
	DEUTSCH CO	BANNING, CA
•	DIAMOND AUTOMATION INC	MIDDLETOWN, OH
	DOVER CORP	CINCINNATI, OH
	E I DUPONT DENEMOURS CO	WILMINGTON, DE
•	JOSEPH DYSON & SON INC	PAINESVILLE, OH
•	EMERSON ELECTRIC CO	MAYSVILLE, KY
	ENGRG SOCIETIES LIBRARY	NEW YORK, NY
•	ESSEX INTERNATIONAL INC	UNION CITY, IN
•	FAGERSTA INC	WEST CALDWELL, NJ
	THE FALK CORP	MILWAUKEE, WI
•	GENERAL DYNAMICS CORP	ST LOUIS, MO
	GENERAL ELECTRIC CO	CINCINNATI, OH
	GENERAL ELECTRIC CO	CINCINNATI, OH
	GENERAL ELECTRIC CO	CLEVELAND, OH
	GENERAL ELECTRIC CO	ERIE, PA
	GENERAL ELECTRIC CO	LOUISVILLE, KY
	GENERAL ELECTRIC CO	SCHENECTADY, NY
	GENERAL ELECTRIC CO	SCHENECTADY, NY
	GENERAL MOTORS CORP	ANDERSON, IN
	GENERAL MOTORS CORP	FLINT, MI
	GENERAL MOTORS CORP	INDIANAPOLIS, IN
	GENERAL MOTORS CORP	SANDUSKY, OH
	GOODYEAR AEROSPACE CORP	AKRON, OH
•	GORTON MACHINE CORP	RACINE, WI
	GOULD INC	CLEVELAND, OH
	GREDE FOUNDRIES INC	MILWAUKEE, WI
•	HAMMILL CO	TOLEDO, OH
•	HANSEN MACHINE COMPANY	GARDEN GROVE, CA
•	HIGH VOLTAGE ENGRG CORP	BURLINGTON, MA
	INDUSTRIAL TOOL & MCH CO	ESMOND, RI
	THE INGERSOLL MILL MACH	ROCKFORD, IL
	INTERNATIONAL HARVESTER	SAN DIEGO, CA
	IRON AGE MAGAZINE	BALA-CYNWYD, PA
	JONES & LAMSON	SPRINGFIELD, VT
•	KAYDALT MFG CO	DAYTON, OH
•	KEENE STATE COLLEGE	KEENE, NH
	KELSEY-HAYES CO	SPRINGFIELD, OH
	KLIK INDUSTRIES	PORTLAND, CT
•	KRAFFT CUSTOM GRINDING	SPRINGFIELD, OH
	LATROBE STEEL CO	LATROBE, PA
	LING-TEMCO-VOUGHT INC	DALLAS, TX
•	LITERATURE RESRCH ASSOC	DURHAM, NH
	LOCKHEED AIRCRAFT CORP	SUNNYVALE, CA
	LODGE & SHIPLEY CO	CINCINNATI, OH
•	LUKENS STEEL CO	CINCINNATI, OH
•	MANGANESE STEEL FORGE CO	PHILADELPHIA, PA
	MARTIN MARIETTA CORP	DENVER, CO
	MASTER CHEMICAL CORP	PERRYSBURG, OH
•	MC CULLOCH INDUS, INC	MINNEAPOLIS, MN
	MC DONNELL DOUGLAS CORP	LONG BEACH, CA
	MC DONNELL DOUGLAS CORP	SANTA MONICA, CA
	MC DONNELL DOUGLAS CORP	ST LOUIS, MO
	MICHIGAN TECH UNIV	HOUGHTON, MI
•	MINNESOTA MINING & MFG	ST PAUL, MN
•	MINNESOTA MINING & MFG	ST PAUL, MN
•	MOBIL OIL CORPORATION	PAULSBORO, NJ
	MONARCH MACHINE TOOL CO	SIDNEY, OH
•	NASCO ENGINEERING INC	EL SEGUNDO, CA
	NATIONAL AERONSPACE ADM	CLEVELAND, OH
•	NATIONAL AERONSPACE ADM	HOUSTON, TX
	NATIONAL AUTOMATIC TL CO	RICHMOND, IN
•	NATIONAL BUREAU STANDRDS	WASHINGTON, DC
	NATIONAL LEAD CO	ALBANY, NY
	NATIONAL LEAD CO OF OHIO	CINCINNATI, OH
	DEPT OF THE NAVY	INDIANAPOLIS, IN
•	DEPT OF THE NAVY	QUONSET POINT, RI
	NORTH AMERICAN ROCKWELL	CANOGA PARK, CA
	NORTH AMERICAN ROCKWELL	LOS ANGELES, CA
	NORTH AMERICAN ROCKWELL	TULSA, OK
	PEARL EQUIPMENT CO	NASHVILLE, TN
•	ROBERT G PETIT	W TERRE HAUTE, IN
	POLYMET CORPORATION	CINCINNATI, OH
	PRATT & WHITNEY AIRCRAFT	EAST HARTFORD, CT
•	RAY W PRATT SPEC TOOL	DAYTON, OH
•	PRECISE TOOL & ENGRG CO	LEES SUMMITT, MO
•	PRECISION TOOL & DIE	SHREVEPORT, LA
	PROTEX COMPANY INC	CHERRY HILL, NJ
	R S C ASSOCIATES	CLINTON, NY
	REX CHAINBELT INC	DOWNERS GROVE, IL
	ROCKWELL MFG CO	PITTSBURGH, PA
	JOS T RYERSON & SON INC	CHICAGO, IL
•	SEALED POWER CORP	MUSKEGON, MI
•	SHARKMAN ASSOCIATES	IRVINE, CA
	SMALL BUSINESS ADMIN	BALA CYNWYD, PA
	SMALL BUSINESS ADMIN	BOSTON, MA
	SMALL BUSINESS ADMIN	DALLAS, TX
	SMALL BUSINESS ADMIN	JACKSON, MS
	SMALL BUSINESS ADMIN	MINNEAPOLIS, MN
	SMALL BUSINESS ADMIN	NEW YORK, NY
•	PAUL G SPAULDING ASSOC	SYRACUSE, NY
•	ST JOE MINERALS CORP	MONACA, PA
	STRUCTURAL DYNAMICS RES	CINCINNATI, OH
•	SUNDSTRAND CORP	AMES, IA
•	TEK INC	DAYTON, OH
	TOOL SALES & SERVICE	CINCINNATI, OH
	TRW INC	CLEVELAND, OH
	TRW INC	DANVILLE, PA
	TWIN CITY TOOL COMPANY	OLATHE, KS
	U S STEEL CORP	HOMESTEAD, PA
	UNION CARBIDE CORP	OAK RIDGE, TN
	UNITED AIRCRAFT CORP	EAST HARTFORD, CT
	UNIVERSITY OF VERMONT	BURLINGTON, VT
•	VORTEC CORPORATION	CINCINNATI, OH
	WALKER MACHINERY CO	CINCINNATI, OH
•	WARNER GEAR COMPANY	MUNCIE, IN
•	WEBSTER ELECTRIC	RACINE, WI
	WENDT-SONIS UNIMET	ROGERS, AR
	WEST MILTON PREC TOOL CO	VANDALIA, OH
•	WESTINGHOUSE ELECTRIC	MEDIA, PA
	WESTINGHOUSE ELECTRIC	PHILADELPHIA, PA
	WESTINGHOUSE ELECTRIC	PITTSBURGH, PA
	WHEELLOCK LOVEJOY & CO	CINCINNATI, OH
	WILLEYS CARBIDE TOOL CO	DEARBORN, MI

POTENTIAL FOR MDC SERVICES TO INDUSTRY

STATISTICAL SUMMARY OF METALWORKING PLANTS PARTIAL LIST FROM DUN & BRADSTREET METALWORKING, DIRECTORY 1972				MDC SUMMARY OF INQUIRIES FOR 8 SIC GROUPS OCTOBER 1, 1971 – JULY 31, 1972		
STANDARD INDUSTRIAL CLASSIFICATION (SIC) NUMBER & INDUSTRY CLASSIFICATION	MAJOR PRODUCT MANUFACTURED NO. OF COMPANIES*	NO. OF INDIVIDUALS		NUMBER OF MDC COMPANIES	NUMBER OF MDC INQUIRERS	TOTAL INQUIRIES
MAJOR GROUP 19 ORDNANCE & ACCESSORIES	131	124,619		3	5	6
MAJOR GROUP 37 - TRANSPORTATION EQUIPMENT SIC INDUSTRY NO.						
3721 - AIRCRAFT & MISSILES	72	266,006		6	7	7
3722 - AIRCRAFT ENGINES & PARTS	126	143,162		8	13	14
3729 - AIRCRAFT PARTS & AUXILIARY EQUIPMENT	398	112,866		3	3	3
MAJOR GROUP 33 - PRIMARY METAL INDUSTRIES	3,580	1,172,228		16	16	17
MAJOR GROUP 34 - FABRICATED METAL PRODUCTS, EXCEPT ORDNANCE, MACHINERY & TRANSPORTATION EQUIPMENT	9,329	1,221,162		6	8	8
MAJOR GROUP 35 - MACHINERY, EXCEPT ELECTRICAL	9,520	1,749,256		53	61	80
MAJOR CROUP 36 - ELECTRICAL MACHINERY, EQUIPMENT & SUPPLIES	5,135	1,669,035		9	13	19
TOTAL	28,291	6,458,334		104	126	154

* 20 or more employees

DESCRIPTION OF MDC DATA PUBLICATIONS

October 1, 1971 – July 31, 1972

DESCRIPTION & CONTENT	NO. OF COPIES DISSEMINATED	SALES INCOME
AFMDC 65-1, MACHINING DATA FOR TITANIUM ALLOYS, AUGUST 1965 Turning, Face Milling, End Mill Slotting, Peripheral End Milling, Drilling, Reaming, Tapping, Broaching, and Surface Grinding for Commercially Pure Titanium, Alpha & Alpha-Beta, and Beta Alloys.	58	$ 87.00
AFMD 66-1, MACHINING DATA FOR NUMERICAL CONTROL, DECEMBER 1966 Contains all the data originally printed in the 7 individual reports, AFMDC 66-1.1 through 66-1.7	66	438.00
AFMDC 66-2, GRINDING RATIOS FOR AEROSPACE ALLOYS, JUNE 1966 Surface Grinding of Alloy Steels, Ultra-High Strength Steels, Tool Steels, Stainless Steels, Titanium Alloys, High Temperature Alloys, Refractory Alloys, and Nonmetallics.	35	35.00
AFMDC 66-3, MACHINING DATA FOR BERYLLIUM METAL, JUNE 1966 This booklet covers problems involved in machining beryllium, in addition to specific data for 10 conventional operations and 4 alternate machining methods.	78	68.00
AFMDC 68-1, DETERMINATION AND ANALYSIS OF MACHINING COSTS AND PRODUCTION RATES USING COMPUTER TECHNIQUES, AUGUST 1968 This data publication describes a practical approach to the problem of obtaining machining costs and production rates. It includes equations, numerous computer calculations, and computer source program listings.	63	219.00
AFMDC 68-2, 1968 SUPPLEMENT TO MACHINING DATA FOR NUMERICAL CONTROL, AUGUST 1968 This supplement is a companion volume to Machining Data for Numerical Control (AFMDC 66-1). Machining data are presented for the newer aerospace materials.	50	150.00
AFMDC 70-1 MACHINING OF HIGH STRENGTH STEELS WITH EMPHASIS ON SURFACE INTEGRITY, JUNE 1970 This book was prepared from data collected on various high temperature alloys and both conventional and nonconventional machining operations. The emphasis in the presentation of machining data and information is on providing guidelines for maintenance of high surface quality and in particular high surface integrity.	68	1,020.00
USAF MACHINABILITY REPORTS, VOL. 1 thru 4	10	185.00
MACHINING DATA HANDBOOK, 2nd Edition	1,877	65,695.00
TOTAL	2,305	67,897.00

MDC OPERATING COSTS

October 1, 1971 -- July 31, 1972

INPUT COSTS		
TECHNICAL EVALUATION		$25,975.43
DATA PROCESSING		19,407.69
DOCUMENT ACQUISITION & REPRODUCTION		5,126.95
		50,510.07
EQUIPMENT, SUPPLIES & SERVICES		9,431.71
	TOTAL	$59,941.78
OUTPUT COSTS		
INQUIRIES		
TECHNICAL EVALUATION		$10,844.80
DATA PROCESSING & RETRIEVAL		502.84
DATA ACQUISITION & REPRODUCTION		744.59
		12,092.23
DATA PUBLICATIONS COMPLETED & IN PROCESS		27,639.49
MACHINING DATA HANDBOOK		71,312.55
EQUIPMENT, SUPPLIES & SERVICES		5,702.89
		104,654.93
	TOTAL	$116,747.16
GENERAL DISSEMINATION		
GENERAL DISSEMINATION OF MACHINABILITY DATA AND CENTER INFORMATION		$16,417.42
EQUIPMENT, SUPPLIES & SERVICES		1,316.05
	TOTAL	$17,733.47
REPORTS		
MDC, MSD AND INFORMATION BRANCH MEETINGS, ETC.		$ 6,984.60
EQUIPMENT. SUPPLIES & SERVICES		21,133.34
	TOTAL	$10,932.76
SYSTEMS ANALYSIS, MODIFICATION & CONTROL		
TECHNICAL EVALUATION		$ 127.14
TECHNICAL & SYSTEMS ASPECTS		21,133.34
		21,260.48
EQUIPMENT, SUPPLIES & SERVICES		1,535.39
	TOTAL	$22,795.87
TOTAL ACTUAL COSTS NOT INCLUDING FIXED FEE (10/1/71--7/31/72)		$228,151
TOTAL ACTUAL COSTS NOT INCLUDING FIXED FEE (10/1/70--9/30/71)		201,480
TOTAL COSTS FOR CONTRACT PERIOD		$429,631
CREDIT FOR REVENUE FROM SALE OF DATA PRODUCTS		138,042
NET COST PER CONTRACT		$291,589

AS OF JULY 31, 1972, $70,800 REVENUE HAS BEEN ACTUALLY BILLED -- THE REMAINING $67,242 WILL BE REALIZED FROM THE SALE OF THE REMAINING 2,870 BOOKS ON HAND JULY 31, 1972.

ESTIMATED COST SAVINGS RESULTING FROM MDC'S OPERATION

OCTOBER 1, 1964 – JULY 31, 1972

COST SAVINGS RESULTING FROM MDC'S RESPONSE TO SPECIFIC INQUIRIES

Total Number of Specific Inquiries 6,793

Estimated Total Number of Machining Situations Included in the 6,793 Inquiries - 33,965

Estimated Savings per Machining Situation Response - $800.00

Estimated Total Savings Resulting from Specific Inquiries - 33,965 Machining Situations x $800.00 = $27,172,000.00

COST SAVINGS RESULTING FROM MDC'S 14 DATA PUBLICATIONS

Total Number of Data Publications Copies Distributed - 21,599

Estimated Number of Machining Situations Utilized per Data Publications Copy - 5

Estimated Total Number of Machining Situations - 21,599 Data Publication Copies x 5 - 107,995

Estimated Savings per Machining Situation - $300.00

Estimated Total Savings Resulting from Data Publications - 107,995 Machining Situations x $300.00 = $32,398,500.00

TOTAL ESTIMATED COST SAVINGS RESULTING FROM MDC'S OPERATION

$59,570,500.00

ECONOMIC ENVIRONMENT FOR MDC OPERATIONS

(ANNUAL COSTS)

Labor and Overhead Costs for Operating Metal Cutting Machine Tools in the United States

Total number of metal cutting machine tools in the metalworking industries	=	2,500,000*
Average labor cost + overhead	=	$8.00 per hour
Average working day	=	8 hours
Number of working days per year	=	250
Average number of direct labor personnel per machine	=	1
Total cost of labor + Overhead: 2,500,000 x $8.00 x 8 x 250 x 1	=	$40,000,000,000

$40,000,000,000

*Based on American Machinist Tenth Inventory (1968)

Total Shipments Including Exports of Metal Cutting Type Metalworking Machinery

$1,097,718,000

Source: U.S. Department of Commerce (1970)

Machine Tool Accessories Industry

Small cutting tools for machine tools and metalworking machinery in the amount of $670,000,000, includes $45,500,000 for tool holders.

Source: U.S. Department of Commerce (1970)

MDC INPUT & OUTPUT SUMMARY

SYSTEM INPUT

October 1, 1964 – July 31, 1972

Document and Card Totals

Documents Entered into the System (including Specific Inquiries)

Oct. 1, 1964 – Jan. 31, 1967		17,576
Feb. 1, 1967 – Jan. 31, 1968		3,695
Feb. 1, 1968 – Sept. 30, 1968		2,341
Oct. 1, 1968 – July 31, 1969		3,316
Aug. 1, 1969 – Sept. 30, 1970		5,638
Oct. 1, 1970 – Sept. 30, 1971		3,408
Oct. 1, 1971 – July 31, 1972		1,525
	Total	37,499

Evaluated Documents (including Specific Inquiries)

Oct. 1, 1964 – Jan. 31, 1967		9,367
Feb. 1, 1967 – Jan. 31, 1968		3,734
Feb. 1, 1968 – Sept. 30, 1968		2,840
Oct. 1, 1968 – July 31, 1969		3,780
Aug. 1, 1969 – Sept. 30, 1970		7,522
Oct. 1, 1970 – Sept. 30, 1971		2,649
Oct. 1, 1971 – July 31, 1972		2,226
	Total	32,118

Total Cards Punched

Oct. 1, 1964 – Jan. 31, 1967		75,173
Feb. 1, 1967 – Jan. 31, 1968		27,077
Feb. 1, 1968 – Sept. 30, 1968		13,833
Oct. 1, 1968 – July 31, 1969		33,868
Aug. 1, 1969 – Sept. 30, 1970		27,054
Oct. 1, 1970 – Sept. 30, 1971		11,316
Oct. 1, 1971 – July 31, 1972		9,491
	Total	197,812

SYSTEM OUTPUT

Data Publications		Copies Distributed
AFMDC 65–1,	Machining Data for Titanium Alloys	6,334
AFMDC 66–1,	Machining Data for Numerical Control	1,393
AFMDC 66–2,	Grinding Ratios for Aerospace Alloys	1,156
AFMDC 66–3,	Machining Data for Beryllium Metal	1,554
AFMDC 68–1,	Determination & Analysis of Machining Cost & Production Rates Using Computer Techniques	1,149
AFMDC 68–2,	1968 Supplement to Machining Data for Numerical Control	897
AFMDC 70–1,	Machining of High Strength Steels with Emphasis on Surface Integrity	582
	USAF Machinability Reports, Vol. 1 thru 4	79
	Machining Data Handbook, 2nd Edition	1,877

MDC VISITS FOR ACQUISITION AND DISSEMINATION OF MACHINABILITY INFORMATION

October 1, 1971 – July 31, 1972

THE MACHINING CONFERENCE - Participated -
The Cleveland State University – Division of Continuing Education
Cleveland, Ohio
November 2, 1971

FIELD TRIP FOR DISSEMINATION OF INFORMATION
Southern California Aerospace Contractors
February 20–25, 1972

DSA-NTIS-IAC CONFERENCE - Participated -
Sponsored by Defense Supply Agency
NTIS Headquarters
Alexandria Virginia
March 7–8, 1972

WESTEC THE THIRD AIR FORCE METALWORKING CONFERENCE Participated -
Los Angeles, California
March 13–17, 1972

SME INTERNATIONAL ENGINEERING CONFERENCE AND TOOL EXPOSITION Attended -
Chicago, Illinois
April 24–28, 1972

7th ANNUAL OHIO VALLEY INTERNATIONAL TRADE CONFERENCE - Attended -
Cincinnati, Ohio
April 28, 1972

AMERICAN SOCIETY FOR INFORMATION SCIENCE REGIONAL CONFERENCE Attended -
Theme: Cost Reduction in Information Systems
University of Dayton
Dayton, Ohio
May 19–21, 1972

NATIONAL SYMPOSIUM ON TECHNOLOGY TRANSFER - Participated -
Washington, D. C.
June 12–16, 1972

SYMPOSIUM: SURVIVAL AND GROWTH: THE SMALL R&D FIRM - Attended -
Washington, D. C.
June 12–16, 1972